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Andrew J. Barnes

Virginia Commonwealth University, abarnes3@vcu.edu

Nicholas Robert

US Oncology Network

Cathy J. Bradley

Virginia Commonwealth University, cjbradley@vcu.edu

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Job attributes, job satisfaction and the return to health after breast cancer diagnosis and treatment

Andrew J. Barnes, M.P.H., Ph.D.¹

Nicholas Robert, M.D.²

Cathy J. Bradley, Ph.D.^{1,3}

¹Department of Healthcare Policy and Research
Virginia Commonwealth University School of Medicine

² U.S. Oncology Network

³Virginia Commonwealth University Massey Cancer Center

Corresponding Author:

Andrew James Barnes, Ph.D.

Assistant Professor

Department of Healthcare Policy and Research

VCU School of Medicine

P.O. Box 980430

Richmond, VA 23298-0430

Phone: (804) 827-4361

Fax : (804) 628-1233

Email: abarnes3@vcu.edu

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Abstract

Background: As detection and treatment of cancer has advanced, the number of working age women with breast cancer has increased. This study provides new information on the intersection of breast cancer treatment and job tasks and how, together, they impact employed and newly diagnosed women.

Methods: The sample comprised 493 employed women within two months of initiating treatment. Job satisfaction and demands were assessed by pre-diagnosis recall along with measures of mental and physical health and assessed again nine months after initiating treatment. Using seemingly unrelated regression, we tested the effect of job tasks and satisfaction on mental and physical health nine months post-treatment initiation, controlling for pre-diagnosis health status, patient characteristics, and job tasks.

Results: Physical job demands prior to diagnosis were not significantly associated with mental or physical health nine months after treatment initiation. Employment in cognitively demanding and less satisfying jobs was associated with decreases in mental health and increases in problems with work or daily activities nine months post-treatment initiation ($p < 0.05$). Women who received five or more cycles of chemotherapy reported lower vitality, social functioning, and worse measures of physical health compared to those who did not receive chemotherapy ($p < 0.05$).

Conclusions: Employment in cognitively demanding and unsatisfying jobs may impede mental health recovery, particularly in patients who receive longer chemotherapy regimens. Such information may be used by patients and clinicians in deciding when to undergo chemotherapy and whether job tasks can be restructured to hasten recovery.

Introduction

As the detection of and treatment for cancer have advanced, the number of working age women with breast cancer has increased [1]. For both personal and financial reasons, many employed women remain attached to their jobs during treatment and desire to return to their jobs once treatment is complete. Outpatient chemotherapy and radiation are often managed such that many employed women work throughout treatment. In a seminal call to action, the Institute of Medicine highlighted employed cancer survivors' need for interventions to minimize the negative impact of cancer and its treatment on survivors' workplace performance [2]. Yet, little is known about how treatment type and job characteristics influence patients' health and successful return to work, creating challenges for effective interventions.

This study provides new information on the intersection of treatment and job attributes and how they impact the physical and mental well-being of employed women newly diagnosed with breast cancer. Women who require several months of chemotherapy and/or radiation experience greater work interruption than women treated with surgery alone. These women are more likely to go on disability, stop working, or retire relative to women who did not receive chemotherapy [3]. The side effects of chemotherapy, which include pain, fatigue, and memory changes, among others, can continue for several months or even years following the completion of treatment [3-5]. Nonetheless, cancer patients with strong commitments to their work organization or a good social climate at work report less mental and physical impairment [1, 6-7]. In addition, a wide work-related social network is associated with fewer depressive symptoms among women with cancer [7]. However, how the combination of treatment, job tasks, and job satisfaction are correlated with employed women's recovery has not been investigated. A more complete understanding of these associations may improve patient and provider decision-making

regarding chemotherapy as well as lead to interventions that can minimize cancer's negative workplace consequences and a more expeditious recovery from treatment.

Methods

Sample

We enrolled 625 employed women diagnosed with breast cancer within two months of initiating treatment with intent to cure. To obtain this sample, we collaborated with three hospital-based treatment centers and five private oncology centers from urban and rural areas within Virginia. Inclusion criteria were: between age 21 and 64 years, employed, and because this study was part of a larger study that aimed to study the impact of health insurance on work outcomes, women had to be insured either through their employer or through a spouse's employer, if married. The original study was powered to detect statistically significant differences in weekly hours worked between married women insured by their employer and those insured by their spouse's employer. Therefore, the study sample has a disproportionate number of married women.

Study notification letters were mailed to potentially eligible patients' physicians; four physicians refused contact. Interviewers telephoned women to further screen for eligibility (n=1,001). Of these, 17.9% of women refused to participate; 10.5% were ineligible for the study; and 8.8% could not be contacted. We interviewed 625 women via telephone at three time points: 1) at baseline, where patients were asked to describe their employment situation and health status prior to diagnosis, 2) within two months following surgery or the initiation chemotherapy or radiation, and 3) nine months after initiating treatment. The questionnaires asked information about patients' demographic characteristics, job attributes, job satisfaction, and mental and

physical health status. In addition to the telephone interview, we conducted audits of patients' medical records. These audits extracted information about cancer stage, surgery, chemotherapy regimen, and radiation. Of the 625 women in our sample, 123 were either deceased, too ill to continue, had cancers that had metastasized, or stopped working before the final interview. Of the remaining 502 women, the analytic sample included 493 (79% of those interviewed) with complete outcomes, job attributes, and job satisfaction data.

Mental and physical health outcomes

Mental and physical health measures were assessed at baseline and nine months after initiating treatment. At baseline, patients recalled their mental and physical health status just prior to diagnosis. Twelve mental and physical health outcomes were derived from responses to the SF-36v2 Health Survey and the 10-item Center for Epidemiologic Studies Depression scale (CESD-10) [8-9]. The SF-36v2 Health Survey was scored using QualityMetric's Health Outcomes Scoring Software, version 4.5.1 with the Mental Health Enhanced feature. Eight domain t-scores (vitality, social functioning, role-emotional, general mental health, physical functioning, role-physical, bodily pain, general physical health), the mental and physical component scores (MCS and PCS), and the mental health severity (MHS) score approximates the Beck Depression Inventory (BDI) [10]. The CESD-10 summary score at nine months following treatment initiation was used as an additional measure of depressive symptoms.

Job attributes

Patients were asked whether their job required them to do the following eight tasks "none or almost none of the time," "some of the time," "most of the time," or "all or almost all of the time:" (1) physical effort, (2) lifting heavy loads, (3) stooping, kneeling, or crouching, (4) intense

concentration or attention, (5) analyze data or information, (6) keep up with the pace set by others, (7) learn new things, and (8) have good eyesight. These questions are identical to those used by the Health and Retirement Survey [11]. Response codes ranged from 1 to 4 with higher numbers representing increased task performance. To uncover patterns in variation across the eight job attribute items and thereby potentially combine several of the original measures, we used exploratory factor analysis. Items (1)-(3) loaded onto a factor representing physical job demands (Eigenvalue =1.71, all three items loaded 0.7 or higher) while items (4) – (8) loaded onto a factor representing cognitive demands (Eigenvalue =1.43, items loaded between 0.38 for eyesight and 0.63 for concentration). We estimated an unweighted average of items (1) – (3) as the physical demand measure and an unweighted average of items (4) – (8) as the cognitive demand measure. The cognitive and physical demand measures were internally consistent with Cronbach's alphas of 0.82 and 0.66, respectively.

Job satisfaction

We assessed job satisfaction at baseline using the 20-item short form of the Minnesota Satisfaction Questionnaire (MSQ) [12-13]. Responses to each item were on a five point Likert scale with higher numbers representing more satisfaction (i.e., not satisfied, somewhat satisfied, satisfied, very satisfied, extremely satisfied). An unweighted average of responses to the 20 job satisfaction items was included in our analysis.

Covariates

Baseline measures of mental and physical health were included in all estimations to adjust for pre-diagnosis physical and mental health. Educational attainment was categorized as high school or less, some college, bachelor's degree, and advanced degree. Demographic

characteristics included age, race/ethnicity (patient self-reported as non-Hispanic African American, other race/ethnicity, or non-Hispanic White), marital status, having children under age 18, and annual household income of less than \$40,000, \$40,000-\$74,999, \$75,000-\$150,000, and \$150,000 or more. Employer-level controls included type of industry (government, private for-profit, private non-profit, and self-employed); and size of employer (less than 25, 25-49, 50-99, and 100 or more employees).

We included an indicator for whether the patient received only radiation treatment between the baseline interview and the nine-month interview and, for those receiving chemotherapy, indicators for chemotherapy regimens of 1 to 4 cycles or 5 or more cycles. Indicators representing whether the patient received hormone therapy and Herceptin treatment were also included separately in our model. A dummy variable for whether the patient was still in treatment at the time of the nine-month interview was also included. Most women had completed treatment (79.9%). Of the 493 women in the analytic sample, missing data indicators were added as covariates to include the 3.3% of our sample missing the treatment indicator for nine months and the 2.2% who were missing income information.

Statistical analysis

Mental and physical health outcomes are closely related. Therefore, we allow for covariance between error terms of the equations by jointly estimating a system of 12 linear regressions using a generalized least squares estimator (i.e., Zellner's seemingly unrelated regression [SUR] [14]), which is more efficient than estimating these equations separately [15]. SUR allows for joint Chi-square tests of significance of job attribute and satisfaction coefficients across sets of mental and physical health outcomes [15]. The Breusch-Pagan test rejected the

hypothesis that the error terms in the 12 equations were independent ($p < 0.05$) confirming that estimating the system of regressions simultaneously with correlation among the error terms was appropriate. Statistical significance was determined at the 5 percent level.

Role of the funder: The funding source had no involvement in the study design, data collection, data analysis, or in writing the paper

Results

Sample characteristics

Women were, on average, 49 years old. The majority of women had at least a college education (59.3%), were married (78.9%), did not have children under age 18 (61.3%), were non-Hispanic White (83.6%) and resided in households earning \$75,000 or more per year (69.4%) (Table 1). About half of the women worked in private, for-profit firms (47.0%) and 72.8% worked in businesses with 100 or more employees. Women reported a baseline physical job demand score of 1.71 (SD 0.77) suggesting that their jobs required physical effort, lifting heavy loads, and stooping, kneeling and crouching approximately “some of the time.” The average baseline cognitive demand score of 3.11 (SD 0.59) suggested that women’s jobs required intense concentration or attention, analyzing data or information, keeping up with the pace set by others, learning new things, and good eyesight “most of the time.” The majority of women were satisfied, very satisfied or extremely satisfied with their job. The average woman reported a job satisfaction score of 3.36 (SD 0.60). Most (72.8%) received radiation or hormone (62.3%) therapy between baseline and nine months after initiating treatment while 16.6% and 51.1% of women received 2 to 4 cycles or 5 or more cycles of chemotherapy, respectively. Few women were on Herceptin (15.8%) or were receiving treatment at the nine month interview (16.8%).

Women reported, on average, physical and mental health prior to diagnosis above the U.S. population (Table 2). The mean baseline MHS and CESD-10 scores were 5.09 (standard deviation (SD) 5.25) and 4.12 (SD 4.80) respectively, suggesting that the average woman did not experience depressive symptoms before diagnosis. However, by nine months after treatment initiation, mental and physical health deteriorated ($p<0.05$). The average MHS and CESD-10 scores increased to 6.14 (SD 5.35) and 6.05 (SD 5.49) ($p<0.05$), respectively, but remained below the threshold for mild depressive symptoms (CESD-10 score of 10 or more) [9].

Adjusted associations of job attributes, job satisfaction and mental and physical health

Mental health and depression nine months after treatment initiation

Physical job demands pre-diagnosis were not significantly associated with mental health measures nine-months after treatment initiation. Cognitive job demands were negatively associated with mental health outcomes nine months after treatment initiation (joint Chi-square test 13.98, $p=0.05$). Increasing whether a woman's job pre-diagnosis required cognitive tasks "some of the time" to "most of the time" was associated with a 2.25 point decline in vitality, a 1.74 decrease in social functioning and a 1.27 point decline in mental component score (MCS) ($p<0.05$ each, Table 3, full model results in Appendix 1). To put the effect sizes of occupational attributes on health outcomes among these patients into perspective, a recent study found breast cancer survivors' MCS score declined 2.9 points after diagnosis and treatment compared to age matched controls [16].

Job satisfaction was positively correlated with mental health measures (joint Chi-square test 14.66, $p<0.05$). Increasing job satisfaction from, for example, "somewhat satisfied" to "satisfied" was associated with increases in vitality (2.52 points, $p<0.05$) and general mental

health (2.59 points, $p<0.05$). Likewise, job satisfaction was associated with increases in MCS (2.32 points) and decreases in MHS (1.61 points) and CESD-10 measures of depressive symptoms (1.16) ($p<0.05$ each). Receiving radiation therapy, hormone treatment, and Herceptin were not associated with mental health outcomes. However, receiving chemotherapy for 2 to 4 cycles was associated with decreases in social functioning (2.70 points) and chemotherapy regimens of 5 or more cycles was associated with decreases in vitality (2.69 points) ($p<0.05$ each).

Physical health nine months after treatment initiation

Physical job demands were not significantly associated with physical health nine months after treatment initiation. Cognitively demanding occupations were associated with patients reporting increased problems at work or with other social activities due to physical health (role-physical) and with decreases in overall physical health (PCS). Shifting cognitive demands, on average, from “some of the time” to “most of the time” was associated with a decrease in role-physical (1.93, $p<0.05$) and weakly associated with decreases in PCS (1.23, $p<0.10$) (Table 3). Relative to surgery alone, chemotherapy was associated with declines in physical functioning (2.53 points for 2 to 4 cycles, 3.36 points for 5 or more cycles), role-physical (3.24 points for 5 or more cycles), bodily pain (2.61 points for 5 or more cycles), general health (2.51 points for 5 or more cycles), and PCS (2.67 points for 2 to 4 cycles, 3.94 points for 5 or more cycles) ($p<0.05$ each).

Discussion

Approximately 40% to 60% of all cancer survivors are employed when diagnosed [17]. An important part of successful survivorship for many is return to work at prior capacity. Our

study finds new evidence that cognitive job demands and job satisfaction prior to diagnosis influence survivors' ability to return to their pre-diagnosis mental and physical level of functioning. Greater job satisfaction prior to diagnosis had a positive influence on mental recovery. This evidence suggests that employees' beliefs and affective experiences about their work tasks and the workplace have an important role in the recovery of employed patients; poor job satisfaction prior to treatment initiation may be harbinger of slow recovery.

The effect of cognitive job demands also had considerable influence among women. Women in cognitively demanding jobs who had prolonged chemotherapy experienced declines in physical and mental health including measures of vitality, social functioning and problems at work due to physical health. Several recent studies highlight the increased risk of cognitive impairment associated with chemotherapy (e.g. "chemobrain") [18-19]. Women on chemotherapy for prolonged duration may find it more difficult to return to their former capacity and may become frustrated with their perceived inability to perform at the same level. For women whose cognitive demands cannot be changed or who are highly committed to cognitively demanding occupations, the long-term therapeutic benefit of chemotherapy should, therefore, be evaluated alongside the mental and physical decrements resulting from such treatment. Alternatively, reducing a patient's cognitive job demands, when possible, may mitigate adverse physical and mental health consequences associated with chemotherapy. In either case, our results imply patients and providers should discuss the extent to which job tasks are mutable in making chemotherapy decisions.

The study has five limitations. First, the sample was not randomly selected and instead selected from employed patients treated at several oncology practices within a single state. Therefore, caution should be taken when generalizing the findings. Nonetheless, there is little

reason to believe employed breast cancer patients vary in the outcomes we study. Second, occupational attributes and health measures were self-reported and refer to the time period before diagnosis. Prior evidence suggests cancer patients tend to overstate their pre-diagnosis health status [20]. To the extent pre-diagnosis mental and physical health were similarly biased upwards, the regression estimates reported may understate the association between pre-diagnosis job demands and satisfaction and post-treatment health status. Third, the follow-up interview was nine months following treatment initiation, which may not be reflective of long-term recovery and return to functioning. Thus, patients receiving fewer cycles of chemotherapy would have more time to recover by the nine-month post-treatment interview than women receiving more cycles of treatment. However, the majority of women receiving 5 or more cycles of chemotherapy had completed treatment 20 weeks or more prior to the nine-month interview whereas those who had fewer cycles completed treatment 27 weeks prior to the nine-month interview. Furthermore, our nine-month follow-up period limits our results to short-run associations between job attributes and health following diagnosis of and treatment for breast cancer. Nonetheless, prior research using a 2-6 year recall period has found that, compared to healthy controls, cancer survivors report lower levels of energy and mental resilience while working, poorer physical and mental work ability, and worse physical and mental health [21]. Fourth, our analysis allows us to estimate the adjusted associations between job demands, job satisfaction, and health outcomes. We cannot infer a causal relationship from our modeling approach. Lastly, the sample includes only those who remained at work. The exclusion of women who stopped working in our sample is likely to bias the results towards the null given that women who were unable to remain working may have been in worse health and in more demanding occupations than those who remained employed. Indeed, prior evidence suggests

cancer survivors in occupations that are more physically straining have more difficulty returning to work after diagnosis and treatment [22].

This study provides new evidence that cognitive job attributes and job satisfaction influence health status following breast cancer treatment. Although our study provides preliminary evidence of the short-term associations of job attributes and health following cancer treatment, if confirmed by subsequent studies, a practical implication of this research is the need to prospectively evaluate a new patient who is a candidate for adjuvant chemotherapy regarding her work environment. Knowing this information provides clinicians an opportunity to advise patients in deciding whether to undergo chemotherapy when employed in a cognitively demanding job or whether job tasks and work flow can be restructured to increase patients' tolerance of chemotherapy. This latter implication also suggests that workplace interventions to increase women with breast cancers' ability to return to pre-treatment employment levels should be explored and evaluated.

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical Standards

The study complied with the current laws of the United States of America and was approved by the institutional review board of the university where the research was conducted.

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Table 1. Sample characteristics (n=493)

Variable	Pre-diagnosis
Job attributes, Mean (SD)	
Physical	1.71 (0.77)
Cognitive	3.11 (0.59)
Job satisfaction	3.36 (0.60)
Cancer Treatment	
Radiation	72.8%
Hormone therapy	62.3%
Chemotherapy treatment	
2 to 4 cycles	16.6%
5 or more cycles	51.1%
Herceptin	15.8%
In treatment at nine-month interview	16.8%
Missing in treatment at nine months	3.3%
Age in years, Mean (SD)	48.99 (7.64)
Educational attainment	
High school degree or less	13.2%
Some college or AA degree	27.5%
Bachelor's degree	32.9%
Advanced degree	26.4%
Household structure	
Not married	21.1%
Have children under age 18	38.7%
Annual Household Income	
< \$40,000	8.7%
\$40,000-\$74,999	21.3%
\$75,000-\$149,000	47.5%
\$150,000 or more	20.3%
Missing income	2.2%
Race/Ethnicity	
Non-Hispanic White	83.6%
Non-Hispanic African American	13.8%
Other	2.6%
Type of industry	
Government	34.9%
Private, for-profit	47.0%
Private, non-profit	13.0%
Self-employed	5.1%
Number of employees	
Under 25	16.6%
25-49	5.1%
50-99	5.5%
100 or more	72.8%

Notes: SD=Standard deviation; CESD-10=10 item Center for Epidemiologic Studies Depression scale

Table 2. Physical and mental health pre-diagnosis and 9 months after initiating treatment (n=493)

Variable	Pre-diagnosis	9-months post-tx initiation	t-test	p-value
SF-36v2				
Domain t-scores, Mean (SD)				
Physical functioning	54.96 (4.74)	49.62 (8.31)	15.06	<0.01
Role-physical	55.02 (5.12)	48.66 (8.81)	15.94	<0.01
Bodily pain	56.55 (8.07)	49.23 (9.49)	15.11	<0.01
General physical health	56.95 (8.60)	51.64 (9.55)	12.64	<0.01
Vitality	55.24 (8.73)	49.08 (9.36)	13.59	<0.01
Social functioning	53.62 (6.81)	49.21 (9.85)	9.75	<0.01
Role-emotional	53.54 (6.16)	50.77 (8.16)	7.55	<0.01
General mental health	53.89 (8.30)	52.13 (8.44)	4.26	<0.01
Summary measures				<0.01
Mental component score	53.12 (8.13)	51.24 (8.91)	4.52	<0.01
Physical component score	56.27 (5.73)	48.89 (8.86)	18.78	<0.01
Mental health severity	5.09 (5.25)	6.14 (5.35)	-3.97	<0.01
CESD-10	4.12 (4.80)	6.05 (5.49)	-7.72	<0.01

Table 3. Adjusted associations of job attributes and job satisfaction with physical health and mental health outcomes (n=493)

Physical and Mental Health Outcomes	Physical job demands β (95% CI)	Cognitive job demands β (95% CI)	Job satisfaction β (95% CI)	Up to 4 cycle of chemotherapy	5 or more cycles of chemotherapy
SF 36 domains					
Physical functioning	--	--	--	-2.53** (-4.46, -.059)	-3.36*** (-4.94, -1.79)
Role-physical	--	-1.93*** (-3.22, -0.63)	1.67 * (-0.05, 3.40)	-1.91* (-4.10, 0.28)	-3.24*** (-5.02, -1.46)
Bodily pain	--	--	--	--	-2.62** (-4.53, -0.71)
General physical health	--	--	--	-1.90* (-4.13, -0.07)	-2.51** (-4.32, -0.70)
Vitality	--	-2.25*** (-3.57, -0.92)	2.52** (0.76, 4.29)	-2.00* (-4.25, 0.26)	-2.59** (-4.42, -0.76)
Social functioning	--	-1.74** (-3.18, -0.30)	--	-2.70** (-5.14, -0.26)	-1.72* (-3.71, 0.26)
Role-emotional	--	-1.08* (-2.25, 0.10)	--	--	--
General mental health	--	--	2.59*** (1.00, 4.19)	--	--
Physical component score	--	-1.23* (-2.48, 0.02)	--	--	-2.67** (-4.78, -0.57)
Mental component score	--	-1.27** (-2.54, 0.00)	2.33** (0.64, 4.01)	--	--
Mental health severity	--	--	-1.61*** (-2.64, -0.58)	--	--
CESD-10	--	0.73* (-0.05, 1.51)	-1.16** (-2.20, -0.12)	--	--

Notes: Non significant results shown as "--", full model results shown in Appendix 1. * p<0.10, **p<0.05, ***p<0.01. All models were estimated with seemingly unrelated regression adjusted for whether the patient received radiation , hormone therapy, Herceptin, age, education, marital status, having children under age 18, annual household income, type of firm, size of firm, and physical and mental health status prior to diagnosis. Breusch-Pagan test of independence of error terms Chi-square = 8,754.11, p<0.01. CESD-10=10 item Center for Epidemiologic Studies Depression scale.